

CLAIMS

1. A regeneration controller for regenerating an exhaust purification apparatus that is arranged in an exhaust passage for an internal combustion engine, wherein the exhaust purification apparatus includes an upstream purification portion and a downstream purification portion, the regeneration controller comprising:

a difference detector for detecting at least one of a difference in exhaust pressure, between a first location upstream from the exhaust purification apparatus and a second location downstream from the exhaust purification apparatus, and a difference in exhaust temperature, between a third location upstream from the downstream purification portion of the exhaust purification apparatus and a fourth location downstream from the third location;

a calculation section for calculating an estimated accumulation amount of particulate matter in the exhaust purification apparatus;

a heating control section for heating the exhaust purification apparatus to eliminate the particulate matter from the exhaust purification apparatus when the estimated accumulation amount is greater than a reference accumulation amount; and

a replacement control section for replacing the estimated accumulation amount with a greater estimated accumulation amount when the estimated accumulation amount falls within a replacement determination reference range due to the heating and the at least one difference is greater than a replacement reference value.

2. A regeneration controller for regenerating an exhaust purification apparatus that is arranged in an exhaust passage for an internal combustion engine, wherein the

exhaust purification apparatus includes an upstream purification mechanism and a downstream purification mechanism that are arranged in the exhaust passage, the regeneration controller comprising:

- a difference detector for detecting at least one of a difference in exhaust pressure and a difference in exhaust temperature between an upstream location and a downstream location of the downstream purification mechanism;

- a calculation section for calculating an estimated accumulation amount of particulate matter in the exhaust purification apparatus;

- a heating control section for heating the exhaust purification apparatus to eliminate the particulate matter from the exhaust purification apparatus when the estimated accumulation amount is greater than a reference accumulation amount; and

- a replacement control section for replacing the estimated accumulation amount with a greater estimated accumulation amount when the estimated accumulation amount falls within a replacement determination reference range due to the heating and the at least one difference is greater than a replacement reference value.

3. The regeneration controller according to any one of claims 1 and 2, wherein the replacement determination reference range includes a value equal to the accumulation amount of particulate matter in the exhaust purification apparatus immediately before the heating is completed.

4. The regeneration controller according to any one of claims 1 and 2, wherein a maximum value of the replacement determination reference range is equal to the accumulation amount of particulate matter in the exhaust purification apparatus when the heating is completed.

5. The regeneration controller according to any one of claims 1 to 4, wherein when an estimated accumulation amount obtained by calculation that is resumed, using the replaced estimated accumulation amount, falls within the replacement determination reference range again and the at least one difference is greater than the replacement reference value, the replacement control section repeats the replacement of the estimated accumulation amount.

6. The regeneration controller according to claim 5, wherein when a state in which the at least one difference is greater than the replacement reference value continues and the number of times the estimated accumulation amount is replaced reaches a stop determination number, the replacement control section refrains from executing the replacement of the estimated accumulation amount until the presently performed heating is completed.

7. The regeneration controller according to claim 6, further comprising:

a correction control section for correcting the replacement reference value to generate a corrected reference value that is used for subsequent heating when a state in which the difference in exhaust pressure is greater than the replacement reference value continues and the number of times the estimated accumulation amount is replaced reaches the stop determination number.

8. The regeneration controller according to claim 7, wherein the correction control section increases the replacement reference value based on the value of the difference in the exhaust pressure when the number of times the estimated accumulation amount is replaced reaches the stop determination number.

9. The regeneration controller according to any one of claims 1 to 8, wherein the regeneration controller is provided with a sulfur elimination mode for restoring the exhaust purification apparatus from sulfur poisoning by releasing sulfur components from the exhaust purification apparatus, and the replacement control section refrains from replacing the estimated accumulation amount when the regeneration controller is in the sulfur elimination mode or when the sulfur elimination mode is requested.

10. A regeneration controller for regenerating an exhaust purification apparatus that is arranged in an exhaust passage for an internal combustion engine, wherein the exhaust purification apparatus includes an upstream purification portion and a downstream purification portion, the regeneration controller comprising:

- a difference detector for detecting at least one of a difference in exhaust pressure, between a first location upstream from the exhaust purification apparatus and a second location downstream from the exhaust purification apparatus, and a difference in exhaust temperature, between a third location upstream from the downstream purification portion of the exhaust purification apparatus and a fourth location downstream from the third location;

- a calculation section for calculating an estimated accumulation amount of particulate matter in the exhaust purification apparatus;

- a heating control section for heating the exhaust purification apparatus to eliminate the particulate matter from the exhaust purification apparatus when the estimated accumulation amount is greater than a reference accumulation amount; and

- a hold control section for holding the estimated accumulation amount when the estimated accumulation amount

falls within a hold determination reference range due to the heating and the at least one difference is greater than a held reference value.

11. A regeneration controller for regenerating an exhaust purification apparatus that is arranged in an exhaust passage for an internal combustion engine, wherein the exhaust purification apparatus includes an upstream purification mechanism and a downstream purification mechanism that are arranged continuously in the exhaust passage, the regeneration controller comprising:

- a difference detector for detecting at least one of a difference in exhaust pressure and a difference in exhaust temperature between an upstream location and a downstream location of the downstream purification mechanism;

- a calculation section for calculating an estimated accumulation amount of particulate matter in the exhaust purification apparatus;

- a heating control section for heating the exhaust purification apparatus to eliminate the particulate matter from the exhaust purification apparatus when the estimated accumulation amount is greater than a reference accumulation amount; and

- a hold control section for holding the estimated accumulation amount when the estimated accumulation amount falls within a hold determination reference range due to the heating and the at least one difference is greater than a held reference value.

12. The regeneration controller according to any one of claims 10 and 11, wherein the hold determination reference range includes a value equal to the accumulation amount of particulate matter in the exhaust purification apparatus immediately before the heating is completed.

13. The regeneration controller according to any one of claims 10 to 12, wherein when a state in which the at least one difference is greater than the held reference value continues and a period in which the estimated accumulation amount is held reaches a stop determination period, the hold control section does not further hold the estimated accumulation amount.

14. A regeneration controller for regenerating an exhaust purification apparatus that is arranged in an exhaust passage for an internal combustion engine, wherein the exhaust purification apparatus includes an upstream purification portion and a downstream purification portion, the regeneration controller comprising:

- a difference detector for detecting at least one of a difference in exhaust pressure, between a first location upstream from the exhaust purification apparatus and a second location downstream from the exhaust purification apparatus, and a difference in exhaust temperature, between a third location upstream from the downstream purification portion of the exhaust purification apparatus and a fourth location downstream from the third location;

- a calculation section for calculating an estimated accumulation amount of particulate matter in the exhaust purification apparatus;

- a heating control section for heating the exhaust purification apparatus to eliminate the particulate matter from the exhaust purification apparatus when the estimated accumulation amount is greater than a reference accumulation amount; and

- a particulate matter elimination continuation control section for continuing the heating until the at least one difference is reduced to be smaller than a continuance reference value when the estimated accumulation amount

reaches a reference value for completing the heating and the at least one difference is greater than the continuance reference value.

15. A regeneration controller for regenerating an exhaust purification apparatus that is arranged in an exhaust passage for an internal combustion engine, wherein the exhaust purification apparatus includes an upstream purification mechanism and a downstream purification mechanism that are arranged continuously in the exhaust passage, the regeneration controller comprising:

a difference detector for detecting at least one of a difference in exhaust pressure and a difference in exhaust temperature between an upstream location and a downstream location of the downstream purification mechanism;

a calculation section for calculating an estimated accumulation amount of particulate matter in the exhaust purification apparatus;

a heating control section for heating the exhaust purification apparatus to eliminate the particulate matter from the exhaust purification apparatus when the estimated accumulation amount is greater than a reference accumulation amount; and

a particulate matter elimination continuation control section for continuing the heating until the at least one difference is reduced to be smaller than a continuance reference value when the estimated accumulation amount reaches a reference value for completing the heating and the at least one difference is greater than the continuance reference value.

16. The regeneration controller according to any one of claims 14 and 15, wherein when a state in which the at least one difference is greater than the continuation reference

value continues and a period in which the heating is continued reaches a stop determination period, the particulate matter elimination continuation control section stops the heating.

17. The regeneration controller according to any one of claims 1 to 16, wherein the exhaust purification apparatus is a catalytic converter including a base coated with a layer of NOx storage reduction catalyst, the base being formed to filter particulate matter contained in exhaust.

18. The regeneration controller according to any one of claims 1 to 16, wherein the exhaust purification apparatus includes:

- a NOx storage reduction catalyst device; and
- a filter, arranged downstream from the NOx storage reduction catalyst device and having a layer of NOx storage reduction catalyst, for filtering particulate matter contained in exhaust.

19. The regeneration controller according to any one of claims 1, 10, and 14, wherein the third location is located in the exhaust purification apparatus, and the fourth location is downstream from the exhaust purification apparatus.

20. An electronic control unit serving as the calculation section, the heating control section, and the replacement control section according to any one of claims 1 and 2.

21. An electronic control unit serving as the calculation section, the heating control section, and the hold control section according to any one of claims 10 and

11.

22. An electronic control unit serving as the calculation section, the heating control section, and the continuation control section according to any one of claims 14 and 15.